

REMARKS/ARGUMENTS

Claims 1, 2, 5-10 and 12 are pending. By this Amendment, claims 3 and 4 are cancelled, claims 1, 5 and 6 are amended, and new claim 12 is presented. Support for the amendments to claims 1, 5 and 6 can be found, for example, in the Declaration Under 37 C.F.R. §1.132 ("Declaration") attached hereto, and in original claims 1 and 3-6. Support for new claim 12 can be found, for example, in the present specification at page 12, line 5 to page 13, line 8, in the Declaration, and in original claim 1. No new matter is added. In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

Personal Interview

Applicants appreciate the courtesies extended to Applicants' representatives by Examiner Langel during the December 18, 2007 Personal Interview. Applicants' separate record of the substance of the interview is incorporated in the following remarks.

Rejection Under 35 U.S.C. §112, Second Paragraph

The Office Action rejects claims 1-11 as indefinite under 35 U.S.C. §112, second paragraph. By this Amendment, claims 3, 4 and 11 are cancelled, rendering the rejection moot as to those claims. As to the remaining claims, Applicants respectfully traverse the rejection.

By this Amendment, claim 1 is amended to recite "T₅₀ represents a temperature per 50 percent recovered as determined by the "test method for distillation at atmospheric pressure" as provided in the standard JIS K2254 "Petroleum products – Determination of distillation characteristics" as revised in 1998." Amended claim 1 sets forth a standard for determining distillation characteristics that is fixed as to time, thus obviating the rejection. Support for the

amendment to claim 1 can be found in the Declaration, which demonstrates that the particular year of the standard is inherent in the disclosure of the present application. *See* Declaration, paragraphs 5 to 7. In particular the standard recited in amended claim 1 necessarily was employed to obtain the data set forth, e.g., in Table 1 at page 21 of the present specification. *See, e.g.*, MPEP §2163.07(a).

For the foregoing reasons, claims 1-11 are definite. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

Rejection Under 35 U.S.C. §102/§103

A. Igarashi

The Office Action rejects claims 1-11 under 35 U.S.C. §102(b), or in the alternative under 35 U.S.C. §103(a), over U.S. Patent No. 5,130,114 to Igarashi ("Igarashi"). By this Amendment, claims 3, 4 and 11 are cancelled, rendering the rejection moot as to those claims. As to the remaining claims, Applicants respectfully traverse the rejection.

Claim 1 recites "[a] desulfurization method, comprising: removing sulfur content from a liquid hydrocarbon with a metallic desulfurizing agent under desulfurization conditions satisfying the following formula (1): $1.06 \times P_{\text{ope}}^{0.44} < T_{\text{ope}}/T_{50} < 1.78 \times P_{\text{ope}}^{0.22}$ (1) wherein: T_{ope} represents operation temperature in °C; P_{ope} represents operation pressure in MPa; T_{50} represents a temperature per 50 percent recovered as determined by the "test method for distillation at atmospheric pressure" as provided in the standard JIS K2254 "Petroleum products – Determination of distillation characteristics" as revised in 1998; hydrogen addition is not employed while removing sulfur content; and the metallic desulfurizing agent comprises a porous inorganic oxide and a metallic element comprising at least nickel (Ni) supported on the porous inorganic oxide" (emphasis added). Igarashi does not disclose or suggest such a method.

Applicants note that Igarashi discloses a catalyst for steam reforming a hydrocarbon. *See, e.g., Igarashi*, Abstract. Igarashi provides no disclosure relating to desulfurization, a process step that precedes reforming, much less the particular desulfurization parameters recited in claim 1. Accordingly, Igarashi fails to disclose or suggest each and every feature of claim 1.

As explained, claim 1 is not anticipated by and would not have been rendered obvious by Igarashi. Claims 2 and 5-10 depend from claim 1 and, thus, also are not anticipated by and would not have been rendered obvious by Igarashi. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

B. Okada

The Office Action rejects claims 1-11 under 35 U.S.C. §102(b), or in the alternative under 35 U.S.C. §103(a), over U.S. Patent No. 5,124,140 to Okada et al. ("Okada"). By this Amendment, claims 3, 4 and 11 are cancelled, rendering the rejection moot as to those claims. As to the remaining claims, Applicants respectfully traverse the rejection.

Claim 1 is set forth above. Okada does not disclose or suggest such a method.

As the Office Action correctly points out, Okada discloses a method for desulfurizing sulfur-containing hydrocarbons. *See, e.g., Okada*, Abstract. However, the desulfurization conditions described in Okada do not correspond to the desulfurization conditions recited in claim 1. As indicated above, claim 1 requires that hydrogen addition not be carried out, and that a nickel desulfurizing agent be employed. Okada discloses three different desulfurization schemes. In the first scheme, hydrogen is not added, but a copper-zinc or copper-zinc-aluminum desulfurization agent is used – a nickel desulfurizing agent is not employed. *See Okada*, column 5, lines 18 to 33. In the second scheme, hydrogen is not added, but a zinc oxide desulfurization agent is used – again, a nickel desulfurizing agent is

not employed. See Okada, column 5, lines 34 to 57. The third scheme is a hydrodesulfurization method – hydrogen is added. See Okada, column 5, lines 18 to 33. Thus, Okada fails to disclose (anticipate) the particular combination of features recited in claim 1.

Okada also fails to render obvious the method of claim 1. It is undisputed that Okada fails to explicitly disclose or suggest the particular desulfurization conditions recited in claim 1. However, the Office Action asserts that it would have been obvious to determine optimum desulfurizing conditions for the process of Okada. In claim 1, desulfurization temperature and pressure are selected based on the T_{50} of the hydrocarbon that is to be subjected to desulfurization. As is well-settled, a particular parameter must first be recognized as a result-effective variable before the determination of workable ranges can be said to be an obvious variation. See, e.g., MPEP §2144.05.II.B (citing *In re Antonie*, 195 U.S.P.Q. 6 (C.C.P.A. 1977)). The Office Action fails to identify, in any of the cited references, recognition that manipulating operating temperature and pressure in a desulfurization process based on the T_{50} of the hydrocarbon that is to be subjected to desulfurization affects performance. Absent such recognition, one of ordinary skill in the art would not have had a reasonable expectation of success upon manipulating operating temperature and pressure based on the T_{50} of the hydrocarbon to be desulfurized.

For the reasons discussed above, a *prima facie* case of obviousness has not been made. However, even if a *prima facie* case were made, such case is rebutted by the results shown in the present specification – "[a] *prima facie* case of obviousness ... is rebuttable by proof that the claimed compounds possess unexpectedly advantageous or superior properties." See MPEP §2144.09 (citing *In re Papesch*, 315 F.2d 381 (C.C.P.A. 1963)). The Examples of the present specification demonstrate that controlling operating temperature and pressure in a desulfurization process within particular parameters based on the T_{50} of the

hydrocarbon to be desulfurized, such as recited in claim 1, provides superior performance (breakthrough life) relative to desulfurization processes in which operating temperature and pressure are not so controlled. *See, e.g.*, present specification, pages 23 to 26, Table 2. These results are objective evidence of the improvements of the method of claim 1 over known desulfurization methods, as in Okada, and thus these results rebut any suggestion that it would have been obvious to modify the method of Okada to employ the parameters recited in claim 1.

As Okada fails to disclose or suggest the particular combination of reaction conditions recited in claim 1, Okada fails to disclose or suggest each and every feature of claim 1.

As explained, claim 1 is not anticipated by and would not have been rendered obvious by Okada. Claims 2 and 5-10 depend from claim 1 and, thus, also are not anticipated by and would not have been rendered obvious by Okada. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

C. Fujisou

The Office Action rejects claims 1-11 under 35 U.S.C. §102(b), or in the alternative under 35 U.S.C. §103(a), over U.S. Patent No. 5,130,115 to Fujisou et al. ("Fujisou"). By this Amendment, claims 3, 4 and 11 are cancelled, rendering the rejection moot as to those claims. As to the remaining claims, Applicants respectfully traverse the rejection.

Claim 1 is set forth above. Fujisou does not disclose or suggest such a method.

As the Office Action correctly points out, Fujisou discloses a method for desulfurizing sulfur-containing hydrocarbons. *See, e.g.*, Fujisou, column 2, lines 10 to 15. However, the desulfurization conditions described in Fujisou do not correspond to the desulfurization conditions recited in claim 1. In Fujisou, desulfurization is carried out "in the presence of a hydrogen-containing gas." *See* Fujisou, column 2, lines 32 to 33. As a result, it

cannot be said that "hydrogen addition is not employed while removing sulfur content," in the desulfurization method of Fujisou, as required by claim 1. Thus, Fujisou fails to anticipate the particular combination of features recited in claim 1.[#]

In addition, Fujisou would not have rendered obvious claim 1 for at least the reasons discussed above with respect to Okada.

As Fujisou fails to disclose or suggest the particular combination of reaction conditions recited in claim 1, Fujisou fails to disclose or suggest each and every feature of claim 1.

As explained, claim 1 is not anticipated by and would not have been rendered obvious by Fujisou. Claims 2 and 5-10 depend from claim 1 and, thus, also are not anticipated by and would not have been rendered obvious by Fujisou. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

D. Shioiri

The Office Action rejects claims 1-11 under 35 U.S.C. §102(b), or in the alternative under 35 U.S.C. §103(a), over U.S. Patent No. 5,026,536 to Shioiri et al. ("Shioiri"). By this Amendment, claims 3, 4 and 11 are cancelled, rendering the rejection moot as to those claims. As to the remaining claims, Applicants respectfully traverse the rejection.

Claim 1 is set forth above. Shioiri does not disclose or suggest such a method.

As the Office Action correctly points out, Shioiri discloses a method for desulfurizing sulfur-containing hydrocarbons. *See, e.g., Shioiri*, column 2, lines 41 to 50. However, the desulfurization conditions described in Shioiri do not correspond to the desulfurization

[#] Applicants note that Fujisou appears to consider the possibility of employing a nickel sorbent in desulfurization processes that do not employ hydrogen. *See Fujisou*, column 4, lines 11 to 18. However, Fujisou does not include specific disclosure of a desulfurization process as recited in claim 1. In every disclosed embodiment of Fujisou, hydrogen is employed in desulfurization. *See, e.g., Fujisou*, column 5, line 60 to column 6, line 58. Fujisou's mere mention of the possibility of employing the disclosed sorbents in a hydrogen-free desulfurization process does not constitute disclosure of the combination of features recited in claim 1.

conditions recited in claim 1. In Shioiri, desulfurization is carried out in the presence of "steam and hydrogen-containing gas." See Shioiri, column 2, lines 45 to 46. As a result, it cannot be said that "hydrogen addition is not employed while removing sulfur content," in the desulfurization method of Shioiri, as required by claim 1. Thus, Shioiri fails to anticipate the particular combination of features recited in claim 1.

In addition, Shioiri would not have rendered obvious claim 1 for at least the reasons discussed above with respect to Okada.

As Shioiri fails to disclose or suggest the particular combination of reaction conditions recited in claim 1, Shioiri fails to disclose or suggest each and every feature of claim 1.

As explained, claim 1 is not anticipated by and would not have been rendered obvious by Shioiri. Claims 2 and 5-10 depend from claim 1 and, thus, also are not anticipated by and would not have been rendered obvious by Shioiri. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

New Claim

New claim 12 recites, *inter alia*, "... identifying distillation characteristics of a liquid hydrocarbon; selecting desulfurization conditions based on the distillation characteristics of the liquid hydrocarbon...." None of the cited remotely discloses or suggests the affirmative steps of identifying distillation characteristics of a liquid hydrocarbon and selecting desulfurization conditions based on those distillation characteristics. Accordingly, claim 12 is believed to be patentable over the references of record.

Conclusion

For the foregoing reasons, Applicants submit that claims 1-11 are in condition for allowance. Prompt reconsideration and allowance are respectfully requested.

Respectfully submitted,

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Declaration Under 37 C.F.R. §1.132